ASTE

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J. A. Siegel, President

W. H. Smila, First Vice-President
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A. M. Sargent, Secretary
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IF you are doing precision boring, you certainly should have this new Bulletin on the Heald No. 47 Bore-Matic.

Here is a single end machine, ideally suited for the manufacturer who has a production of a single piece or a number of parts but not in such volume as to use the full capacity of the No. 46 or Double End Bore-Matic.

While this machine is simple, it is automatic in operation and complete in every detail. It has a very fast boring cycle; is conveniently loaded from either the front or right end with easily changed boring speeds. This last is a very vital factor as exactly the correct speed is necessary when precision boring.

EVERY user of Heald Internal Grinding Machines should know about this new Wheelhead. While it is new in general announcement, it really has been receiving the most rigid tests under actual operating conditions for a long period of time The reports from over 100 heads now in our customers' plants show that many of these Red Heads have been operating constantly for over 2000 hours without the slightest trouble or attention except periodic lubrication.

This wheelhead is distinctively different from all other heads and can be readily identified by a crimson panel bearing the words "Heald Red Head." It is a peppy, rugged, built-for-speed unit that stands the gaff of punishment even under the worst production conditions.

. . . Ask for one or both Bulletins which will be gladly sent upon request . . .

BRANCH OFFICES AT CHICAGO, CLEVELAND, DETROIT AND NEW YORK

The Heald Machine Co.

WORCESTER, MASS.

1933 ELECTION OF OFFICERS

The first annual Nominating Committee of the AMERICAN SOCIETY OF TOOL ENGINEERS was elected at the February general meeting. Their duties are to nominate candidates for office in the Society for the ensuing year.

The Committee is composed of B. L. ("Lee") Diamond, Chairman; William Gray; William Maier; Joseph Lannen; and Clarence Erickson. As prescribed by the Constitution and By-Laws, the names of the candidates chosen by the Committee will be placed on ballots which will be mailed by the Secretary to each of the thirty-three directors; the marked ballots will then be mailed back to the Secretary's office, after which, at a Director's meeting, the ballots will be opened and canvassed, and the results published in the April issue of the Journal.

President J. A. SIEGEL

The new officers will take seat April 1, while the formal installation will take place at the general meeting on Thursday, April 13. It is quite likely that the Meetings Committee will arrange for a dinner to precede the meeting.

The officers to be elected are President, First Vice President, Second Vice President, Secretary, and Treasurer. If in any Director's opinion the Nominating Committee failed to nominate a capable and fitting candidate, he may exercise his franchise by inserting the name of his particular choice on the ballot for any of the offices to be filled.

It is hoped that the Nominating Committee during its deliberations, and the Directors when voting, will realize the importance of their function and choose only such men who, in their unbiassed opinion, are the most capable and best suited for each respective office, and eliminate any idea of setting such precedents which in an open organization such as ours may later prove to be unwise.

By notifying the Nominating Committee that he would not be a candidate for re-election, President Siegel no doubt was desirous of setting what might be considered a favorable precedent, that such a society as the A. S. T. E. should elect a new leader each year.

Mr. Siegel was approached by several members of late with the idea that the present officers should be re-elected for another year because of the Society still being in its organizing period, but to this his answer was that, according to the Constitution, the out-going officers are to remain members of the Board of Directors for a period of one year, which will enable the finishing of any program or act started by them and considered beneficial to the Society by the Board, which is the governing body of the Society.

REPORT OF NOMINATING COMMITTEE

The following is a report of the meeting of the Nominating Committee, held on February 17, 1933.

The nominations were as follows:

President	Mr. W. H. Smila
First Vice-President	Mr. F. L. Hoffman Mr. R. H. Farmer
Second Vice-President	Mr. T. B. Carpenter Mr. W. L. Newton
Secretary	Mr. A. M. Sargent
Treasurer	Mr. Wm. J. Fors Mr. Wm. Peterson

In the absence of more definite instructions governing the proceeding of this Committee, we have, where we thought one certain person to be the most desirable for the office, nominated only one. For the other offices, we have nominated two each.

In nominating these men due consideration was given to equalizing representation, to the candidate'e ability, and to his availability to perform the required duties.

Nominating Committee:

B. L. Diamond, Chairman
Wm. Maier
W. M. Gray
J. Lannen
Clarence Erickson

Next Meeting:

**Thursday,
March 9, 1933.**

**Detroit Leland Hotel,
Colonnade Room,**

Eight o'clock.

Speakers:

**Mr. Boyd H. Work,
Carborundum
Company,
Niagara Falls,
New York.**

Subject: "Abrasives — Their Maunfacture, Their Uses, Recent Development of Same and Safety Practice."

Other Speakers to be announced at meeting.

Mr. Boyd H. Work, who will speak at the March 9, A. S. T. E. meeting, is Sales Engineer for the Carborundum Company, Niagara Falls, New York.

Mr. Work was born at Andover, Ohio, in 1892, and received his technical education at the Carnegie Institute of Technology, Pittsburgh, Pennsylvania. He became connected with the Carborundum Company in 1916, where he gained experience in the manufacture of abrasives. Later, Mr. Work entered the field of research and development of abrasives, and, finally, sales engineering.

MR. BOYD H. WORK

Mr. Work will speak on the subject "Abrasives — Their Manufacture, Their Uses, Recent Developments of Same, and Safety Practice."

Mr. Work's talk will be illustrated by a film, and by samples of crude materials as well as finished abrasives.

The other speaker for the evening will be announced and introduced at the meeting.

NOTICES

One of our members in France is interested in philately, and states that he is in a position to furnish any European stamps which A. S. T. E. members may desire. He will also be glad to furnish information about certain phases of industry in France. Any member wishing to obtain European stamps or information about industry in France write direct to Mr. Alexander Gabay, 45 Rue St. Henri, La Madeleine (Nord), France.

Mr. Gabay would like information in detail about how the cages (split) for the Hyatt Roller Bearings are made, including a description of the operations, tools, and machines used. Any member who can furnish Mr. Gabay this information please write to Mr. Gabay, and, if we are permitted to do so, we should like to print this information in the Journal.

Mr. Sargent, Secretary, reports that we are having a large number of letters returned to us because of change of address of members. Many members indicated on their application blanks that they preferred their mail sent to their business address and may have made different connections since.

All members who have changed their address please send in their new address. Also, if you know of a member who does not receive his Journal or other Society mail please notify the Secretary, or have the member get in touch with him.

EDITORIAL PAGE

DOWN TO EARTH AGAIN

They told me touching tales of the tumble of Wall Street's temples. They lingered long, lamenting lay-offs. They waxed wordy over wage-cutting. They raved about receiverships. They lambasted the luck which led banks to fold their tents and steal away into the night with their nest eggs. They preached the power of prohibition-repeal to profit the people. They derided the doctrine of debt-moratoriums. They were terrified at technocracy and tortured by taxes. They were sympathetic to the strikers, and bawled about the bank holidays. They were eloquent at election-time and demanded a new deal. They condoned communism; ratified radicalism; approved anarchism,- and rooted for Roosevelt.

For many monotonous months, they came into the office and pictured to me the inevitable overthrow of our institutions of "self" government. They told me there were wolves at the door; bears in the bushes; and we were babes in the woods. Darkness was over the face of the earth. God was asleep. Whither should we turn?

They were ready to join a parade whether going up-hill or down. They had my goat and they were crying in the wilderness for a Moses to lead it, with the rest of the flock, to safety—or a new fleecing.

—o—

One summer morning, when I was a little boy on my father's farm, I waked up with my ears ringing with the din of a million seventeen year locusts' chants. They made so much noise I couldn't hear the birds sing. They were so thick I had to walk with my mouth closed.

About ten days later, I was awakened by the crowing of the barnyard rooster, whose punctual morning call, "To work," pierced the early-dawn stillness like an army bugle. The silence tortured my ear drums. The locusts were gone for another seventeen years.

—o—

About two and a half months ago, an old-timer barged into my office, anchored himself comfortably in the easiest chair, steamed up his fat cigar, and proceeded to talk—depression. And this locust's dirge was as startling to me as the barnyard rooster's early morning crowing had been that morning on the farm after the locusts had flown.

It was then that I first realized that the army of solemn-minded depression busters had ceased serenading and had gone to work.

—o—

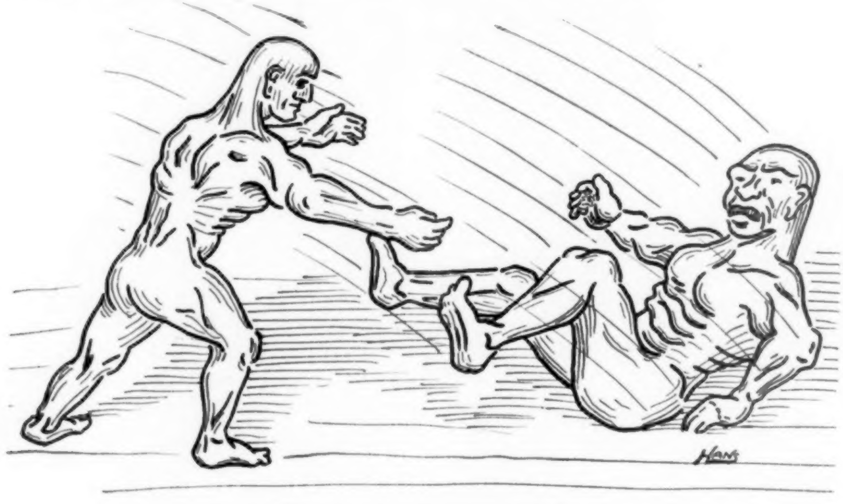
They had learned that neither the President of the United States, nor his commissioners, nor the R. F. C., nor world conferences, could lay even a tiny slice of bread on the tray of the baby's high chair. They had learned that God won't put soles on the boy's shoes and that the only leader to trust is the one residing about an inch above, and somewhere between, the two flaps on their own conning-towers. They had learned that technocracy is yet an infant and all wet about there being no more work for man's muscles as well as his mind.

They have gone to work creating their own little jobs, solving their own big problems, and letting Roosevelt and "Hooey" Long settle the world problems. In short, they have learned self-reliance—and that's why depressions are born. We are like Antaeus*; we have to be knocked down plenty to get the strength we need to save ourselves.

They have learned what it takes an executive a long time to learn, namely; that if he is to be successful, he must learn to deputize specific tasks to certain individuals and then work like hell himself to keep up with them.

Even a tool engineer knows that!

Thus do we emerge from the fog.



*Antaeus was a giant of Libya, long invincible in wrestling because his strength was renewed every time he touched the earth, his mother. The gruesome details of his fight with Hercules are better remembered by most of us than the tragic battle of Waterloo. Hercules throttled him while holding him off the ground. The moral, of course, being that we must keep our feet on the ground and stick to simple facts.

LAST MEETING

GETTING HOME FROM THE FEBRUARY MEETING

Members who braved the sub-zero temperature and icy blasts prevailing on February 9 to come to the monthly A.S.T.E. meeting had the pleasure of hearing two illustrated talks by Mr. Harry F. Vickers, and Mr. K. R. Herman, of VICKERS, Inc., Detroit. Below are transcripts of the talks prepared for the Journal by the two above gentlemen.

HYDRAULIC CONTROL OF MACHINE TOOLS
By HARRY F. VICKERS, of Vickers, Inc.

The first consideration in developing circuits for the hydraulic operation of machine tools is a satisfactory pump. Pumps for hydraulic operation are divided into two classes: (1) Those in which the pump displacement is constant and variations in feed rate are accomplished by valving, and (2) those in which the displacement is varied to secure variations in feed rate.

Fig. 1 shows the performance curves of two pumps used in the first class (to which this discussion will be confined). The curve at the left is from a well made gear pump similar to many that were manufactured by our company prior to the development of the balanced vane type pump with the performance shown by the right hand curve. It will be noted that the pump displacement curve drops off very rapidly in the case of the gear pump; consequently, the volumetric efficiency curve is parallel to it. Also the power input and power output curves diverge considerably after the pressure rises. These characteristics are also reflected in its rapidly falling overall mechanical efficiency curve.

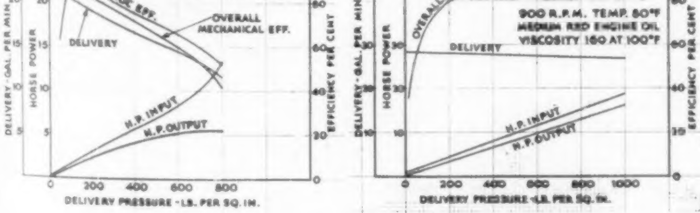


Fig. 1. Performance comparison of gear pump and Vickers' Vane Type Pump.

The right hand curve shown is that of a pump developed to meet the exacting requirements of machine tool feeds and relatively high pressure applications of many other types. Contrasting this with the performance of the gear pump, it will be noted that the delivery curve is almost flat even though the chart covers a range from zero to 1000# per square inch, while the gear pump stops at 800# per square inch. The corresponding horsepower input and output curves reflect this improved performance, as does the overall mechanical efficiency.

The construction of this vane type pump (see Fig. 2) consists of a rotor with a number of vanes which operate inside a hardened and ground ring of unusual design. This ring has two positions in which the vanes are allowed to slide out, and which

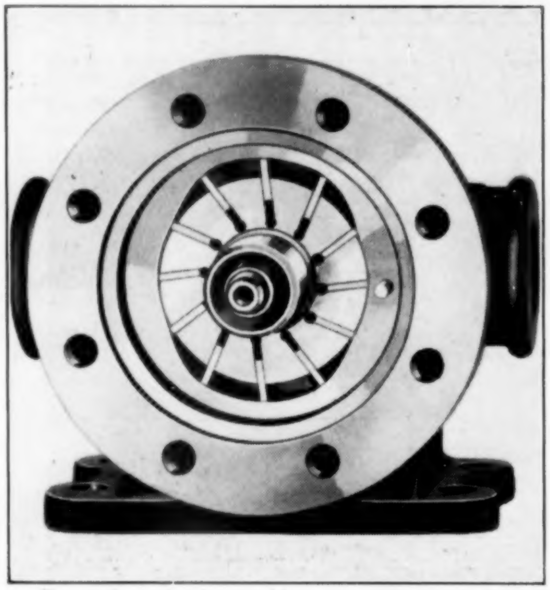


Fig. 2. Internal view of high-pressure vane type pump.

are used for displacing liquid. Each of these pumping chambers has an inlet and outlet port. This results in two chambers of exactly equal area operating at the same pressure directly opposite one another which, of course, means that the pump is in hydraulic balance. An additional feature consists of the ring being formed so that a sliding motion of the vanes takes place outwardly while the inlet port is still open, and inwardly only after the exhaust port has opened. The advantage of this construction is that the vane is never forced to slide in the slot of the rotor when it has side pressure against it. It can readily be seen that this materially reduces slot wear. This type of construction makes it possible to replace all wearing parts of the pump without removing it from the machine, disconnecting the pipes or disconnecting the motor drive. The wearing parts may be entirely replaced by removing the rear cover only.

A number of valve types are used to secure the varied sequence of operations and cycles required in machine tool design. One of the most important of these types is the feed control valve for accurately controlling the rate of flow of oil, and consequently accurately regulating the feed rate of a tool head or other machine tool part. Other valves required are pilot valves, 4-way valves, relief valves, and by-pass valves.

Particular attention is called to the feed control valve which is so designed that it is completely self-compensating for changes in operating pressure. This feature makes it possible to maintain a uniform feed rate whether the tools are cutting at their maximum load, or without any cutting load at all. An additional feature is that the oil is usually metered out of the exhaust end of the cylinder, which results in the piston advancing steadily because it is held between the pump pressure on one side and the back pressure on the other side. With this method of feeding, no jump or surge ahead occurs when a tool breaks through the work; complete control is had even though the back pressure required should momentarily be greater than the pump pressure on the other side. The installation of a feed control valve in this position in the circuit completely eliminates pump slippage or leakage of the 4-way valve as a source of variation in feed

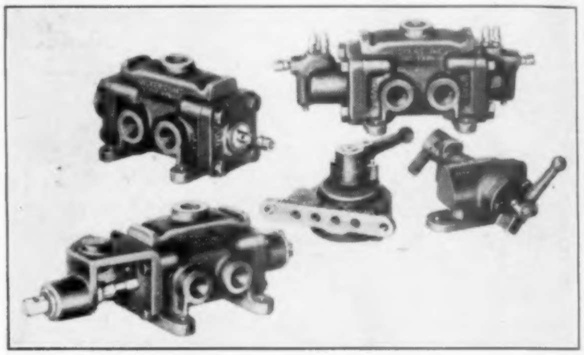


Fig. 3. Group of 4-way pilot valves.

rate. It also makes possible the control of small cylinders at very slow feed rates, having been successfully operated on a feed of .060″ per minute on a 2″ diameter cylinder.

The relief valve that we use is also of unusual design. The ordinary poppet type relief is dependent upon the weight of the spring being overcome by the oil pressure against a ball or angle seating valve. Relief valves of this type are subject to chatter at some pressure and volume, usually about the operating range desired. They also have a considerable range between their maximum volume and closing points; this results in an appreciable pressure drop before full volume is again supplied to the system. The relief valve that overcomes these objections consists of a piston operated valve controlled by hydraulic pressure on both sides of the piston. The pressure on the upper side (the side which causes the valve to close) is limited by a small pilot pressure adjustment. This valve being operated by hydraulic pressure is not subject to the critical vibration periods which are characteristic of spring type valves. It very successfully controls opening and closing pressures within 20# of the

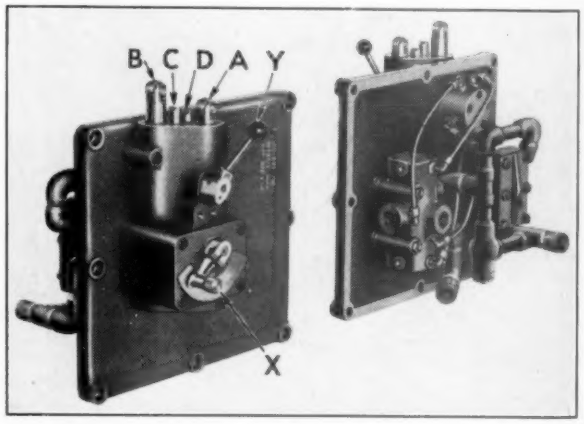


Fig. 4. Panel assembly of complete machine tool feed control circuit.

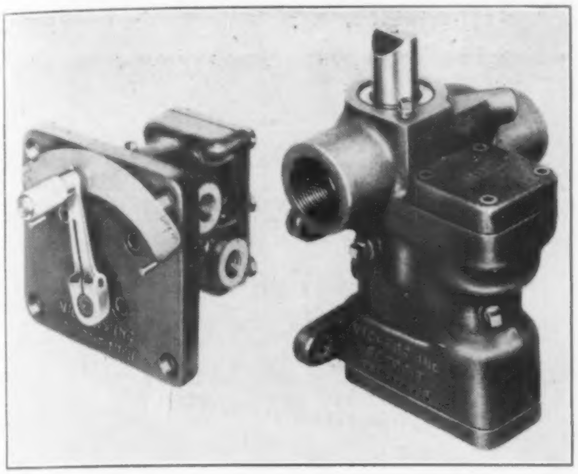


Fig. 5. Two types of pressure compensating feed controls.

set amount, while spring loaded valves quite often have a 100 to 150# range.

Fig. 4 is a panel type assembly which consists of all the control elements necessary to make a circuit for a typical machine tool feed. It is not only a compact unit but also has a very neat appearance. In many cases one of these panels and one of the combination pumps plus a cylinder make a complete hydraulic machine tool feed installation.

We have provided hydraulic feeds and controls to many types of machine tools and a wide variety of other equipment. Included are horizontal way machines for drilling and boring, hydraulic presses, honing machines, boring machines, electric welders, and milling machines. Others are forming and quenching machines, hardness testing machines, furnace walking beam mechanisms, as well as crankshaft turning machines. A particularly interesting application is that of hydraulic step-drilling for the drilling of deep holes. Automatically the drills advance rapidly, drill a predetermined depth, back out rapidly and approach rapidly to the point of drilling, and feed a predetermined step. This continues until the hole is drilled through, at which point the machine reverses and resets the step-drilling controls ready for the next operation. This system is applied also on a large conveyor type machine where eight drills are operated by one hydraulic unit, and the conveyor mechanism is also indexed automatically.

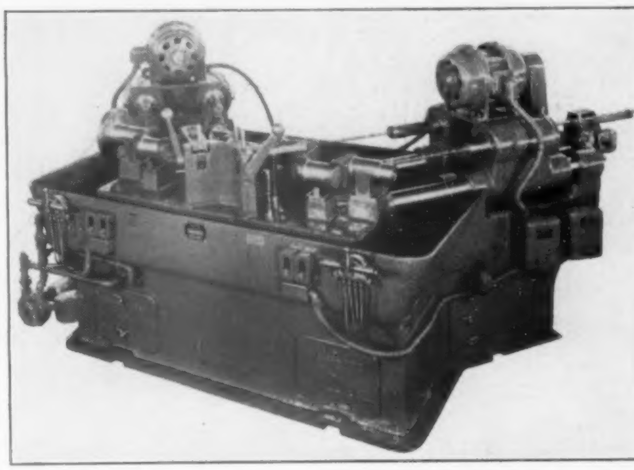


Fig. 6. Application of hydraulic step drilling to special crankshaft machine.

DESIGN CONSIDERATIONS WHEN APPLYING HYDRAULICS TO MACHINE TOOLS

By K. R. HERMAN, of Vickers, Inc.

The designer who is contemplating hydraulic operation of a machine very often considers that a low pressure system is more efficient than a relatively high pressure system. This is not true except on jobs which require a small amount of power, and where the hydraulic elements to be used would be too small. By the following formula:

$$\text{H.P.} = \text{Gal. Per Min.} \times \text{Pressure} \times .00058$$

Applied to two problems it shows that 10 G.P.M. at 100# per square inch is equivalent to 1 G.P.M. at 1000# per square inch; the amount of power in each case is .58 H.P. Also, for two systems equally well designed using pipe sizes allowing the same velocity of flow per unit of time, a loss of 20# per square inch migh be secured. In the case of a system designed for 100# per square inch operating pressure, the loss is 20%, while in an equally well designed system for 1000# per square inch, the loss is only 2%.

Care should be taken in the design of cylinders with special reference to packings and gaskets. It has been found very satisfactory to employ packing in two sections with a drain between these two sections, returning the leakage of the pressure section to the tank. The second section in this case becomes a wiper which merely serves to clean the piston rod. Along this same line gaskets should be thin, not thick, the reason being that a heavy gasket exposes a greater area to oil pressure. We have found in many cases where a .010" gasket will blow out, that one .003" thick is entirely satisfactory. Gaskets should also be narrow so that for a given bolt tightness a higher unit pressure is secured on the gasket.

TYPICAL PROBLEM

Required to drive horizontal drill head
Rapid traverse 150" per min.
Feed twenty ½" drills in 2330 steel
Estimate 150# sq. in. rapid traverse pressure
Thrust required 776# per drill
Feed rate .009" per rev. 445 R.P.M. = 4.005 in. per min.
Total thrust = 20 × 776 = 15,520#
Assume 500# per sq. in. pressure

$$\frac{15.520}{500} = 31.1 \text{ sq. in.} = 7\tfrac{5}{8} \text{ Dia. Approx.}$$

$$\frac{31.1 \times 150}{231} = 20.2 \text{ gal. per min. for rapid traverse}$$

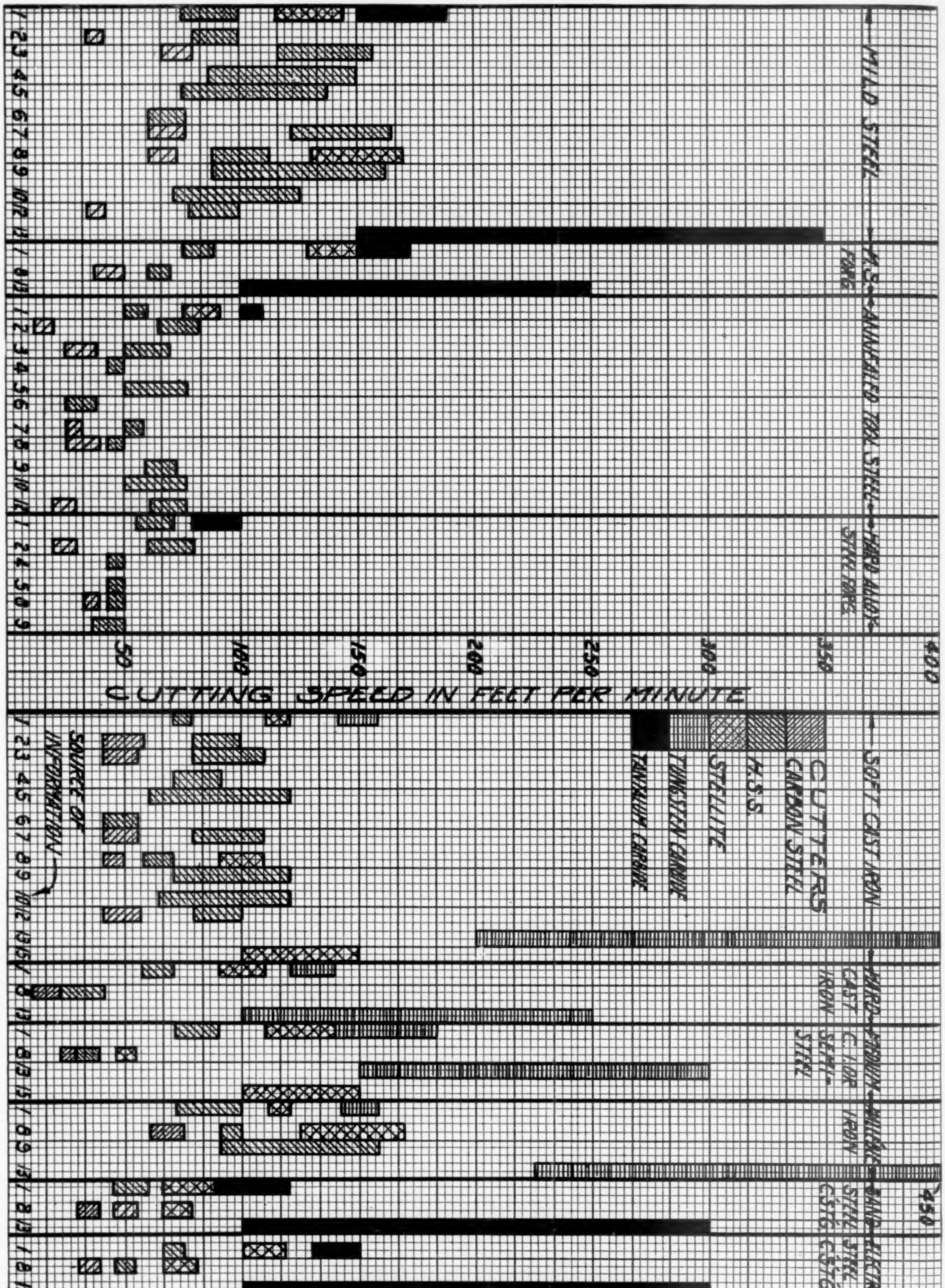
$$\frac{31.1 \times 4.005}{231} = .537 \text{ gal. per min. for feed}$$

Selecting Combination pumps the following performance is secured:

	Capacity	Rapid Approach	Feed
Rapid Traverse Pump	18.7 G.P.M.	150# 2.66 H.P.	0# .5 H.P.
Feed Pressure Pump	2.2 G.P.M.	150# .6 H.P.	500# 1.3 H.P.
Total in rapid traverse	20.9 G.P.M.	3.26 H.P.	1.8 H.P.

Table of milling speeds with various type of cutting materials on different materials, from several sources of information.

Prepared by O. W. Winter, Foreign Correspondent.



Tool Engineering Bulletin No. 16

CHARACTERISTICS AND USES OF TUNGSTEN AND TANTALUM CARBIDES

Tungsten and Tantalum Carbides have come into use as a cutting tool material in the last few years. In many instances these tools have been very successful, while in other cases they have been complete failures.

Up to the present time the best results have been obtained with Turning and Boring tools, and particularly in Cast Iron, Brass, Aluminum and on non-metallic substances such as Fiber, Bakelite, et cetera.

Some success is being had with Inserted Blade Milling Cutters, tipped with these Cemented Carbides, especially in Cast Iron, Aluminum alloys, and the various bronze alloys. In drilling, most applications have been confined to Bakelite, Fiber, and various vitreous materials such as Glass.

In order to successfully apply Cemented Carbides, it is absolutely necessary to have rigidity in the machine and set-up, in the piece to be machined, and in the tool itself. For this reason it is advisable to submit to us all details of such proposed applications for our recommendations as to setup, and particularly as to design of the tool to be used.

It should be kept in mind that these tools will only pay for themselves where the material and operating conditions are suitable. Where this is the case these tools can be recommended as an economical means of machining, and will, in many cases, return their cost many times over.

Courtesy of C. J. Oxford,
National Twist Drill & Tool Co.

Tool Engineering Bulletin No. 17

DEEP HOLE DRILLING—CHIP DISPOSAL

In Engineering Bulletins Nos. 5 and 11 the construction of drills for deep hole drilling, with suitable feeds and speeds for this type of operation, have been discussed. It has been pointed out that special drill construction is necessary, and that adjustments of feeds and speeds must be made as the depths of holes increase.

The ultimate success in drilling deep, small diameter holes on a production basis, hinges on the ability of getting the drill chips out of the hole and so prevent packing and binding, as well as permitting the cooling fluid to reach the point of the drill. The type of drill sharpening recommended in Bulletin No. 5 is used mainly because it helps to break up the chips into small pieces that will be easily ejected by the drill as it rotates.

As the diameters of holes to be drilled become smaller a point is reached where the chip spaces or flutes are too small to properly allow the chips to pass out of a deep hole. The only remedy is to lift the drill out of the hole at intervals. The drill then carries the chips out with it and permits a fresh start to be made. If this chip removal is done often enough there is hardly any limit to the depth of the hole that can be drilled.

Devices have lately been placed on the market that, when properly attached to a drill press spindle, will perform just this function. Performances of small, deep hole drills have been greatly enhanced in this way, both as to number of holes drilled per grind and number of grinds per drill. To illustrate this an actual case study is presented herewith:

Material to be drilled	S.A.E. 1112
Diameter of hole and drill	$\frac{5}{32}''$
Depth of hole	$4\frac{1}{8}''$
Distance drilled between removals of drill from hole	$\frac{5}{32}''$
Drilling time - Total	1 min. 20 seconds
Number of holes per grind	150
Drill breakage	None

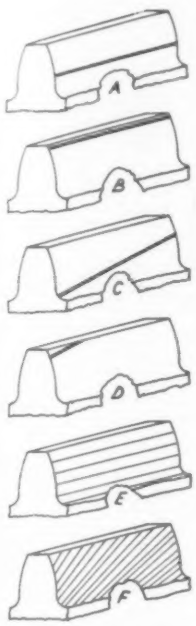
Inasmuch as the removal and re-insertion of the drill was automatic and extremely rapid, little time was lost on that account as can be seen from the total time consumed per hole.

A comparison of the above figures with results obtained under older methods, where the drill was removed less frequently, shows that the number of holes per grind was several times more, and the time was only a fraction of that required in the past. No better argument for this method of drilling deep holes could be presented.

Courtesy of C. J. Oxford,
National Twist Drill & Tool Co.

HELICAL GEARS VERSUS SPUR GEARS

By O. H. SCHAFER*



Lines of Contact on Gear Teeth.

A, B. Adjacent Spur Teeth Bearings.
C, D. Adjacent Helical Teeth Bearings.
E. Successive Spur Gear Bearings.
F. Successive Helical Gear Bearings.

The growing importance of helical gears in automobile transmissions brings out one very important difference between these gears and the previously used spur gears. It has been found that in certain cases, the helical teeth, under similar test conditions were disrupted or shattered without the cause being readily recognized. An analysis of this situation, when carefully made, will disclose the fact that helical gears in some respects are weaker than spur teeth of the same pitch, pressure angle and face width; although, the general opinion of the industry is that they are considerably stronger due to the great number of teeth in action.

To show the above feature, we submit a few sketches; one showing the line of contact on spur gears, either in single or multiple tooth contact; another showing the line of contact between helical gears in single tooth contact and in multiple tooth contact.

It is to be noted that the multiple tooth contact on helical gears gives a possible condition where the one tooth if perfect would give a diagonal long bearing, and the entering or leaving tooth would have a very small diagonal end bearing.

Assuming that there was a small variation in spacing between the teeth, then it would be recognized that it is possible that the long bearing on the one tooth would be lost and the whole load would be carried by the small end bearing on the corner of the tooth either entering or leaving. Spur gear teeth under similar circumstances would still have a bearing on the entering or leaving tooth across the full face width and not shortened because of the small diagonal end bearing. This fact shows the great desirability of obtaining the utmost accuracy in spacing and profile on helical gears, so as to avoid the overloading of these ends of teeth.

Helical gears in quantity production have been found to be very much quieter than spur gears under present manufacturing conditions. This is largely due to the greater tooth bearing area, and the fact that spacing errors are better distributed, being spread over several teeth; whereas, spacing errors in spur teeth tend to accelerate and decelerate the gears causing rattle.

In the lapping of modern transmission gears, the same functions which improve quietness of operation in the helical gears permit of very rapid lapping of the profiles and also improve the action of the gears by removing the undesirable errors from profile cutting, heat-treat distortion, etc., any one of which can readily overload the diagonal small end of the helical teeth by causing a variation in the tooth action. Assuming that proper attention has been given to the important previous operations, consistent quality can be obtained by rotary lapping, which tends to eliminate these dangerous elements which cause shattering or breaking of the ends of the teeth.

*Gear Engineer, Hudson Motor Car Company.

Mr. James R. Jones, formerly with the Detroit College of Applied Science, has returned to the Traveler's Insurance Company, with whom he was formerly connected. He is affiliated with the Detroit branch office, located at 2600 Union Guardian Building.

The WESSON COMPANY, 1050 Mt. Elliott Street, Detroit, are placing on the market a full line of Interchangeable Counterboring Tools in connection with their Tungsten Carbide (Widia Tools.) Mr. J. H. Smith, President of the Company, who has had many years experience in the counterboring field, claims many advantages in the new Wesson Tools, the chief of which is the elimination of any inserted driving members either on the tools or in the holders. Their adjustable holders have no checknuts or other exposed parts that would prevent smooth running in a bushing, and may be adjusted for length to within a fraction of 0.001 in., over a range of 1¼ in.

TUNGSTEN CARBIDE BORING

Some Late Examples of the Use of the Carbide Metals for Boring

By JAMES B. GIERN*

The machining of cylinder barrels presents one of the most interesting machine operations. The cylinder wall is frail and exposed to great strain in the process of boring, and consequent heating and warping plays havoc in the course of this work.

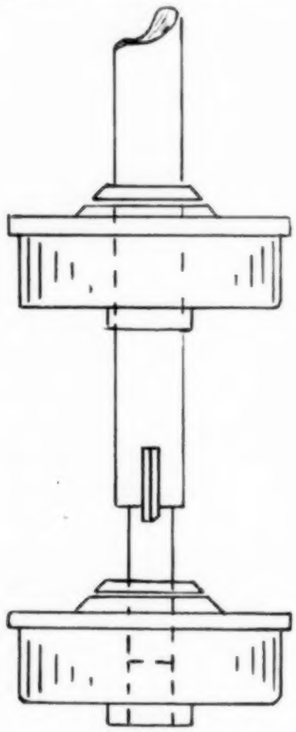


Fig. 1. Boring tool guided on both sides.

Generally, cylinder boring is done in three phases; these are, rough boring, semi-finishing, and finish boring or reaming.

The second operation, or semi-finishing, is in a fashion a corrective process, and since the subsequent operation ordinarily is carried on by means of floating tools, precaution should be exercised on this semi-finish process, inasmuch as the following tool will follow the bore. Ordinarily, from 1/16" to 3/32" is removed in the semi-finishing operation.

Boring tools (boring bars) should be guided on both sides of the cut by means of bushings, preferably rotating bushings, for the reason that by the use of this sort of bushing a close fitting, high speed, and non-fouling front pilot is possible.

Fig. 1 illustrates a general arrangement of the above description. Fig. 2 is a cylinder boring tool built for semi-finish boring automobile cylinders. It is interesting to note in this connection that, although the cutter shown at Fig. 3 has a take-up or adjustment of more than ½", more than 20,000 cylinders may be bored without any adjustment.

The advantage in this method of boring lies of course, first and foremost, in the fact that the semi-finished product is *controlled*—that is, each bore is alike. Despite the fact that carbide tools are employed with a very shallow feed, but with a great speed, a surface speed of 250 feet and up invites the designer to simplify the planning out of operations. This is illustrated by the fixture, Fig. 4. The cylinder casting shown here is completely bored and reamed in but two operations. The surface speeds employed are 250 and 350 feet, and the feed per revolution is but 0.015".

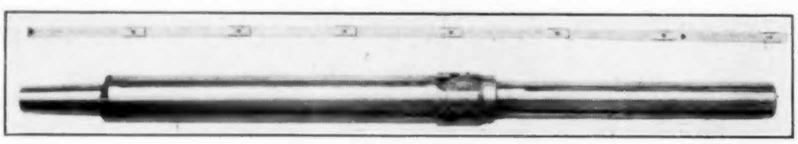


Fig. 2. Cylinder boring tool for semi-finish boring

In this last notation lies the reason for the possibility of producing a perfectly round hole. Accuracy, in this case roundness, is *directly proportional to shallow feed.*

EFFICIENCY OF BORING BARS

It is rather interesting to note the retrogression, as it were, that tungsten carbide has caused in tool engineering—but the fact remains that the two-bladed tool properly guided is marvelously efficient.

One of the reasons may well be sought in the fact of the high velocity. This in itself would call for an extremely free cutting tool. Even single-lip tools are not only coming to the fore—nay, they are highly successful at this writing.

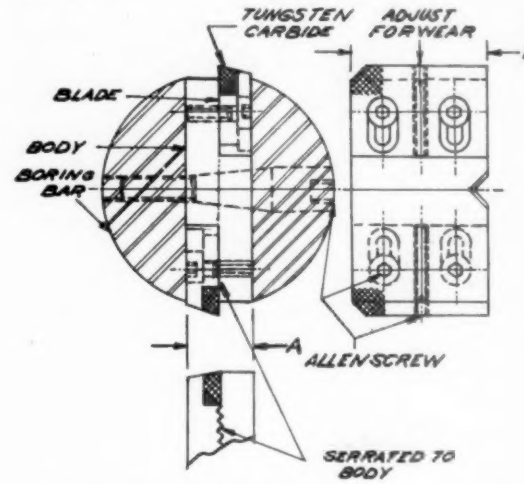


Fig. 3. Cutter used with tool shown in Fig. 2.

AN INTERESTING JOB

Fig. 5 depicts a boring tool used for a boring operation in a cast iron case. The depth of bore, as will be noticed by referring to Fig. 5-B, is but one-half inch. It was decided to do this in one operation; that is, the rough bore cutter passes through the entire bore before the finish cutter begins. The cutter arrangement is shown in Fig. 5-B. The bore is extremely accurate and is designed for a ball bearing housing. The heavy shank is guided by a couple of rotating bushings.

*National Boring Tool Company.

OLD TABOOS AND NEW FACTS

Measured against time, this faculty of tungsten carbide—namely, feed in opposite proportion to speed—results in accuracy, as mentioned before, and this is likely to set up some new practices. For

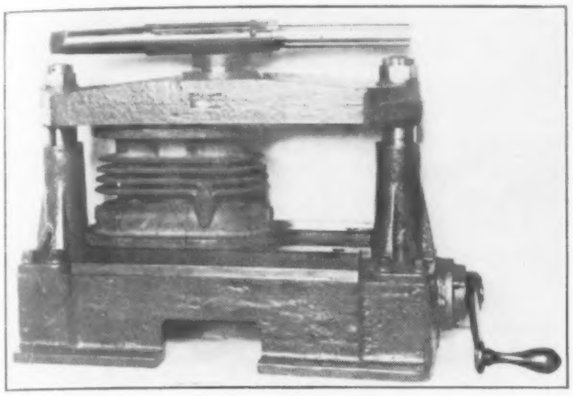


Fig. 4. Fixture for boring cylinder casting.

example, in ordinary practice it is generally thought impractical to arrange a rough-cutter and a finish-cutter immediately following one another. The accepted system is to have one cutter completely

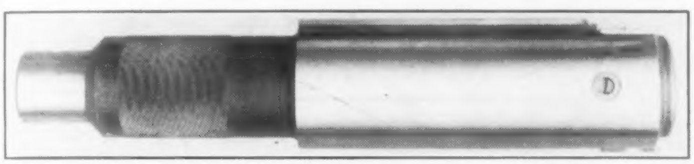


Fig. 5. Boring tool for boring cast iron case.

finish the cut before the other starts. The reason is obvious; the front cutter will invariably ruin the finish-cutter's work.

In Fig. 6 the reader will notice that this theory has been ignored. This illustration is a small gray iron casting with rather frail walls. Fig. 6 also shows a cut of the boring tool used. Note that the front cutter is a solid cutter, whereas the rear cutter can be set according to diametrical wear. This method has been found very practical since a solid cutter not alone is cheaper, but during its life only decreases a few thousandths of an inch diametrically, not enough to disturb the finishing cutter's work. It will also be noted that the boring bar is guided by rotating bushings on both ends. The fit into these bushings is a push fit; consequently, the machine vibrations, if any, are not communicated to the work. Also, the bushings render it possible to attain the proper speed.

Now it is rather interesting to relate the reason for this construction, for sometimes an accident is a lucky strike and has startling results in the direction of improvement. The castings in Fig. 6 has a limit of 0.004". This liberal limit was the immediate reason for the construction of the cutters in close proximity. As a matter of fact, the shallow feed, 0.015", coupled with the keen carbide tools and the bushing guiding, turned the job out perfectly enough to cut the limit to 0.0005" for roundness and straightness. In addition it may be mentioned that the production per hour is 180 pieces. Also, it is proper to state that it is necessary only every second week or so to regrind the tools. Finally, it is noteworthy

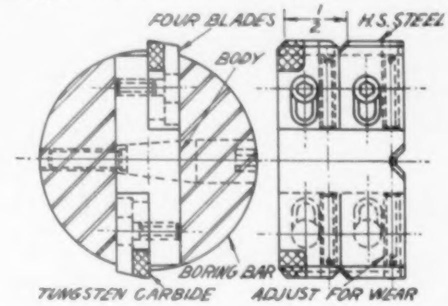


Fig. 5-B. Cutter arrangement for boring cast iron base.

that the castings are but lukewarm on removal from the jig. That fact in itself is proof of the very negligible strain the casting is exposed to during the process.

ANOTHER INTERESTING JOB

The job about to be described is a cast iron base, similar to a transmission case. It has two holes, one $4\frac{7}{32}$" and the other $2\frac{3}{4}$" in diameter, located in line, and at about a distance apart of 20". It was necessary to rough bore both holes simultaneously. Also, in this case bushings were employed, bushings of a character similar to those previously described.

It is clear when it is mentioned that the large hole is being bored with a surface speed of approximately 400 feet that the smaller hole will be bored at about 200 feet. The first is not prohibitive and the last very nearly efficient (efficient being 250). Thus it is evident that measured against *time*, which is the old accepted scale, the job is on a paying basis.

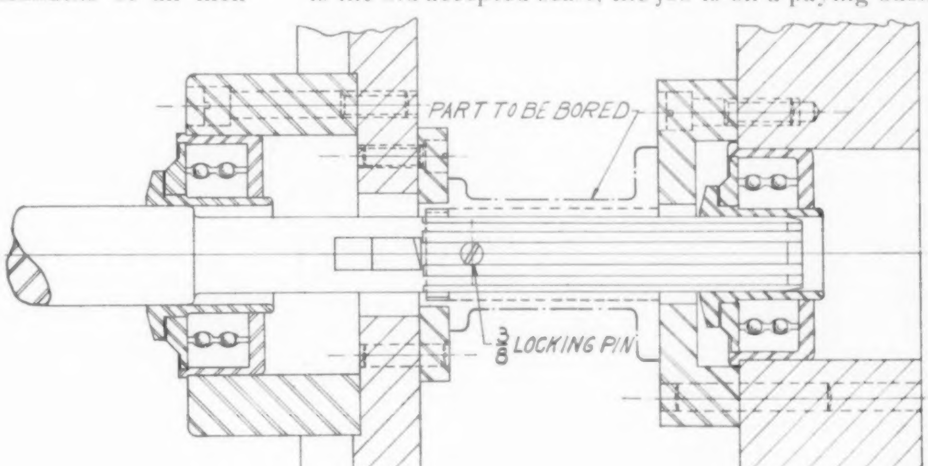


Fig. 6. Boring a small gray iron casting.

NEWS NOTES OF THE INDUSTRY

Hudson-Essex exports for 1932 show that the number of cars exported to countries outside of Canada totaled 3,383 in 1932 as compared with 1,698 in 1931, an increase of over 100 per cent. Prospects for 1933 are excellent, with orders now on hand for 811 cars or 23.8 per cent of 1932 production.

Consumption of crude rubber by manufacturers in the United States for the month of January amounted to 21,661 long tons. This compares with 16,999 long tons for December, 1932, and represents an increase of 27.5 per cent according to statistics released by the Rubber Manufacturers Association.

Additional gains in both retail delivery and factory shipments of Plymouth cars compared to corresponding periods in 1932 were reported by H. G. Moock, general sales manager of the Plymouth Motor Corporation. Retail deliveries for the week ending February 4 are 218.4 per cent ahead of those a year ago.

Following the announcement of the new V-8 passenger car, Ford has announced a new sedan delivery model and a new station wagon mounted on a 112 inch wheelbase. These, as well as the standard delivery model, and the open pick-up job, will be available on the same chassis, which will be fitted with either the ne waluminum-head eight-cylinder engine used in the passenger car chassis, or with what is described as an "improved" four-cylinder engine.

Extensions of the plant of the Hall Manufacturing Company in Toledo are being planned as the result of the industrial acceptance of the new invention, the Hall eccentric valve seat grinder for internal combustion engines.

Steel plant activity in the Youngstown district is holding firmly at 21 per cent of capacity as automobile buying of sheets and strip continue to be a major factor in the schedule of some valley mills.

Rockne dealers' sales to customers in January, 1933, topped those of January, 1932, by 211 per cent, George M. Graham, vice president of Rockne Motors Corporation, reports. January deliveries also show a gain of 50.3 per cent over December.

One hundred and twenty-eight new dealers have joined the Rockne sales organization since the new Rockne line was first announced to the trade last December.

General Motors Corporation ended the year of 1932 with a profit of $164,979, it is revealed in a preliminary statement issued by president A. P. Sloan. The directors declared the regular quarterly dividend of 25 cents on the common stock, and $1.25 on the new $5.00 preferred. The net of $164,970 compares with net earnings of $96,877,107, after nonrecurring losses of $18,343, 400 in 1931.

Group studies of new car registrations for the full 12 months of 1932 show that Chrysler and Studebaker made definite gains in percentage of total registrations during the year. The Chrysler advance was most marked, this group registering 17.5 per cent of the industry total during the year, against only 12 per cent in 1931. The Studebaker advance was from 2.6 per cent in 1931 to 4 per cent in 1932.

Gloating over a 30 per cent gain in attendance and a 100 per cent increase in sales at the Chicago show, the automobile industry turns toward its spring sales period with a renewed optimism. The Chicago show is regarded as giving a more sure indication of the sales outlook than the New York Show, and many believe that the upturn there is a real forecast of the future trend in sales in 1933.

PERSONAL

EXPERT STENOGRAPHER, Female, possessing executive ability; 14 years engineering and general business experience. Thoroughly familiar with technical terminology and routine. Highest references furnished. Write or phone care of A.S.T.E. Secretary, 8316 Woodward Avenue, Madison 2057.

Dad coming to son's fraternity house: "Does Roger live here?"

"Sure. Bring him in."

From a postcard sent by a world-touring father to his son in college:

"This is the cliff from which the Spartans used to throw their defective children. Wish you were here."

Love,
Dad.

Motorist (driving in a college town): Officer, come here quick, I've just knocked down a student.

Cop: Sorry, it's Sunday, you can't collect your bounty until tomorrow.

We are twins and look alike. When we were at school my brother threw an eraser and hit the teacher. She whipped me. She didn't know the difference, but I did. I was to be married, but my brother arrived at the church first and married my girl. She didn't realize, but I did. But I got even for all that. I died last week and they buried him.

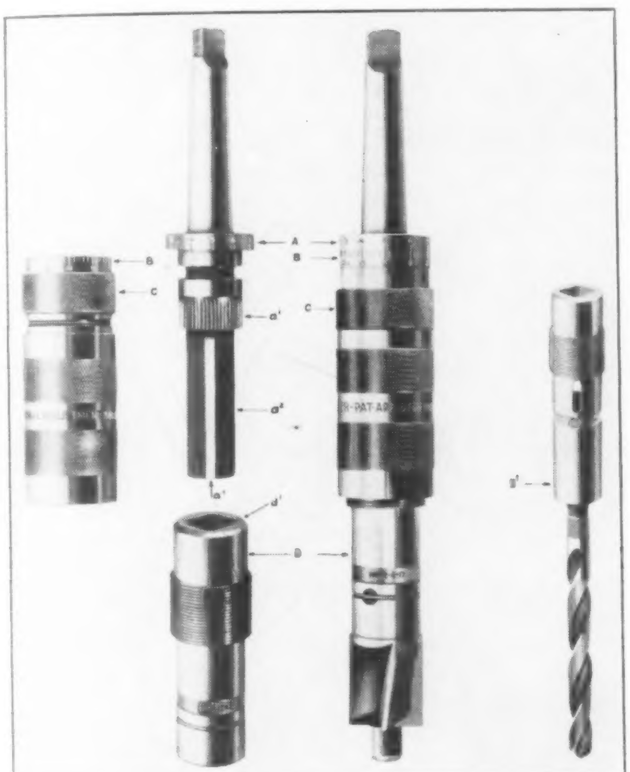
Trainer: Say, I wanna congratulate ya on dis article you writ for de poiper.

Prizefighter: Yeah, dat's what dey tell me. By golly, I wisht I could read.

NEW DEVELOPMENTS IN TOOLS

An interesting new development in adjustable length holders for end cutting tools, reamers, taps, drills, etc. has just been announced by the ECLIPSE COUNTERBORE COMPANY of Detroit.

Instant micrometer adjustment for length (by hand), in conjunction with a constant positive lock in any position, are its principal features. Simplicity in its rugged construction is apparent, and perfect alignment is insured by generous bearing surfaces.



Referring to the illustrations, any changes in length from .001 to 1¼" is instantly accomplished by raising the knurled lock sleeve (C) by hand and turning the adjusting sleeve (B), then lowering the lock sleeve. This is all that is required. A pawl located under this lock sleeve engages the serrations on the driving shank (a^1) and locks the holder against any possible accidental or forcible changes in adjustment.

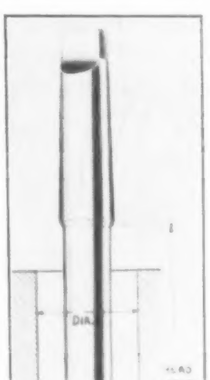
The square stem (a^2) provides a sturdy driving member in the broached hole (d^1) of the cutter holding member or socket (D), and the circular ground corners (a^3) provide perfect alignment in an accurately ground bearing in (D). Thrust is borne by the adjusting sleeve (B) against the thrust flange on driving shank (A).

Standard parts except the cutter socket are used throughout. The socket only, shown as (D) and (D^1), is changed when adapting the holder for use with different types of end cutting tool shanks. (D^1) shows the socket or lower end adapted for use with twist drills.

Eclipse engineers believe that the unusual simplicity of the "MICRO-JUSTABLE LENGTH HOLDER," its compactness, rigidity in locked position, and the extreme ease with which it can be unlocked, adjusted and relocked instantly (by hand) without the need of any tools, make it highly desirable for multiple spindle operations involving accurate depths of counterbored, countersunk, drilled, reamed or tapped holes.

For boring deep holes, the O.K. TOOL COMPANY, Incorporated, Shelton, Connecticut, has developed a Two Bladed Counterbore as illustrated. The ordinary multi-bladed boring tool, while ideal for shallow operations, or where a small amount is left for finishing, is unsuitable for break-down or roughing operations.

When a hole is of some length and considerable metal is removed, the construction as shown must be used. Only two adjustable O. K. Cutter Blades are inserted into a forged and heat-treated alloy steel body. They interlock with a pilot, which guides the tool through the bore. The body is generously cut away so that the chips have easy access to the opening of the hole.



The tools serve as a worthy substitute for large drills being more economical in initial cost and blade replacement.

Tools between 1½ in. and 6 in. diameter are offered. Cutter Blades of drop forged high speed steel, super-cobalt high speed steel, Stellite, or Cemented Carbide are available.

THE IMPORTANCE OF THE CUTTING TOOL IN MACHINING PROCESSES

By A. N. GODDARD*

What is meant by the phrase, "Machining Processes?" Reduced to simplest terms, the answer is, making things by the use of machines—automobiles, pianos, blankets, bricks, locomotives, watches, paper, concrete. In the field of metal working the machines that finally shape the rough castings and ungainly forgings to exactness of dimension and contour, so that a finished product is ready for use, are called *machine tools.* Because they are what might be termed the basic tools, Dexter Kimball, a few years ago, coined the very fine slogan for them, "Machine tools, the master tools of industry," and in so doing conferred a lasting dignity upon the whole machine tool industry.

But, why was a machine tool ever invented, designed, and built? For one purpose only—*to operate a cutting tool* over the surfaces that must be better than forge shop hammers or foundry moulds could leave them; to bring symmetry, trueness of surface, and precision more surely and more quickly than by the infinitely laborious process of the use of cutting tools by hand.

The cutting tool, then, preceded by centuries the machine tool for operating it. Our forbears first used a hard stone with a sharp edge to cut a softer stone. From these man made his implements for the hunt, for warfare, for grinding his grain for food. After he discovered iron and copper in the earth he fashioned better cutting tools, with which he fashioned more easily the other implements that eased his struggle for existence, that gave him greater advantage over his foes, that reduced his effort and added to his comfort of living.

Centuries after these developments, man devised means of reducing his labor in the use of these cutting tools by ingeniously contriving a mechanical means of operating them. He made a fiddlebow drill with which he could more easily and quickly drive his drill point through material. This was the origin of our modern high power radial of today. He held a rough stick in the crotches of two stakes driven in the ground, bent down a birch sapling to which he tied one end of a strand of hemp, took a few turns around one end of his stick and tied the other end to a crude foot treadle. Thus he could rotate the stick while holding a cutting tool against it and finish an arrow or spear shaft better and quicker than he could whittle it out by hand. This was the forerunner of the engine lathe, the tool that today turns a pair of six foot locomotive driving wheel tires to a gage fit in three hours time.

Always the machine tool has been developed to supply a means of holding a piece of work and a means of driving the cutting tool that must finish the surfaces of the work. But so absorbing has been the development of the machine tool that frequently the study of the cutting tool has suffered. "Machine tools, the master tools of industry"—quite right—but without the correct cutting tools to complement their use they become but mere idle ornaments in a shop. Let me then dignify cutting tools with the slogan "Cutting tools, the indispensable tools of industry."

Cutting tools are small tools—drills, reamers, taps, counterbores, milling cutters. Small tools they are called, but they are vital. They must transform into units of finished work every ounce of energy the machine tool can deliver.

Selection of the right material to make machine tools of, adaptation to the work they are to perform, correct design for the freest cutting action, sufficient strength to give rigidity to the cut, number of teeth to give smooth cutting, sufficient freedom for chip egress to avoid clogging, correct clearance back of the cutting edge to support the edge and not drag, proper speed for the kind of material being cut, correct feed of work for maximum production with quality of finish required, proper cutting lubricant for each material machined, proper temper of the tool to have cutting edge last longest between grindings,—these are some of the points that explain the importance of the cutting tool in modern machining operations, that demand as careful engineering thought and study as the development of the machine tool itself.

Cutting tools are classified as "small tools," but the design and manufacture of them is not a small man's job; nor is their careful selection, proper care, and right use in the production shop a matter of little moment.

Machine tools are generally selected after thoughtful investigation and consideration of several types as to which is most suitable or efficient. Machine tools are considered a capital investment and often run into sizeable figures—$5000 for a good knee type miller, $20,000 for a planer type miller requiring a 50 H.P. motor for driving. Milling cutters may cost from $10 to $300 each, depending on size and style. They are not so carefully purchased as machine tools, and yet it is a fact that often a milling machine during its lifetime will use up from one to three times its own capital investment in cutters. More money is lost in many so-called "modern shops" today through the inefficiency of small tools than in the capital investment in machine tools.

It behooves the tool engeineer, then, to pay heed to these things, and remember, "Cutting tools, the indispensable tools of industry."

"Despise not the day of small things."

*Goddard and Goddard Company, Inc., Detroit, Mich.

"TECHNOCRACY"

FROM MODERN MACHINE SHOP

Newspapers and magazines are full of discussion of the new theory of "Technocracy." The technocrats, it seems, comprise an earnest-minded organization of engineers and scientists who are seeking to discover, by means of charts and graphs of the course over which civilization has thus far sailed, just what we are headed for and about when we may expect to arrive.

The high point in their findings to date seems to consist in that the rate at which workers are being displaced by machines is greater than the rate at which new jobs are being created, which would means that we could look forward to a continuous and increasing problem of unemployment.

The old saw "You can prove anything by figures" is just as true today as it ever was. We won't go as far as some of their fellow-scientists, who denounce these men as "technocrazy," but we would like to submit a few figures on replacements of workers by the machine.

Let us go back to the spinning machine, which was probably the first important labor-saving device. The invention and perfection of this machine increased the productivity of a weaver by 700 times. Yet, in 1856, some eighty years after the spinning machine was invented, the employees in the British textile industries numbered 379,000 as compared with 218,000 twenty years previous. By 1914 the number of employees in this industry had reached 689,000. Thus while the population was doubling, the number of workers in this highly machanized industry was trebling. Certainly there is no evidence of technical unemployment here.

The printing industry is another industry in which hand work has been displaced by machines ata rapid rate in recent years. It is estimated that machines have multiplied the production per man by from three to four times within the last thirty years, yet the number of persons employed in the printing trades today is three times as many as were employed in this industry fifty years ago. Again the theory of technical unemployment is disproved. These examples could be multiplied by hundreds.

According to James S. Thomas in "Nation's Business," the drop in American industry between 1920 and 1928 released approximately 2,000,000 workers. That is a huge army to be thrown upon the streets, and represents the loss of a vast sum in wages and salaries—but wait!

During that same period the number of workers employed in the driving and servicing of automobiles—a product of the machine age—increased by 750,000. Expansion in insurance fields increased the number of insurance agents by another 100,000. Electric refrigeration, oil heat, and improvements in light and power provided employment for another 100,000. Construction work and management provided jobs for an additional 100,000, and motion picture theatre employees increased by 125,000. Radio—also a development of this machine age—created jobs for 200,000 people during this same period. The increase in travel, due largely to the automobile, has made necessary increased hotel and restaurant facilities for which an additional force of 750,000 people is required. Altogether," Mr. Thomas says, "while the machine was displacing some 2,000,000 workers in America, the increased efficiency made possible by the machine was providing jobs for more than 2,500,000 people directly and some 2,000,000 more indirectly." The difference more than accounts for the increase in population during the period. At the same time the per capita earning power was increased and the standards of living were raised.

Again we say that while hundreds of thousands of people in this country are without shoes, clothing, fuel, furniture, and food, the absence of foundation for the theory of over-production is obvious. With warehouses on the one side filled with food, clothing, and other necessaries of life, while on the other side are thousands of people who are suffering for the lack of these same necessaries, the problem is obviously one of distribution. When the needs of the destitute and suffering have been fllled, if there is any surplus, then—and not until then—will we be ready to listen to theories concerning the evils of over-production as caused by the development of labor-saving machines.